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De-growth vs. green growth? Let's focus on the common ground to speed up the transition to sustainability!

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Abstract

In the light of anthropogenic climate change, a polarized discussion about the right measures to keep economic activity within the planet's ecological boundaries has emerged: Advocates of de-growth argue that continuous GDP growth is impossible because of natural limits to growth. They call for measures to change individual consumption patterns, to constrain affluence in wealthy countries, and to reform the economic system in such a way that it can fulfil its functions even without continuously growing GDP. Advocates of green growth argue that GDP growth and ecological impacts are conceptionally independent and call for promoting entrepreneurial activity which facilitates the transition towards a carbon-neutral, circular economy without curtailing economic growth. At first sight, the two views appear in unresolvable conflict. After sketching the two approaches, we point towards their common ground and argue that the conflict may concern ideologies rather than evidence-based policy proposals. Taken seriously, both call e.g. for urgent action; for fundamental reforms to correct faulty price signals; for promoting a circular economy powered by regenerative energy sources; for political measures which enable sufficient life styles; and for evidence-based rather than ideological economic analysis. Focusing on this common ground may accelerate the vital transition to a sustainable economy.

Keywords

economic growth, green growth, de-growth, ideological economics

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1. Introduction

Except for the financial crisis around 2009, the world's gross domestic product (GDP) grew at positive rates since the 1960s (Worldbank, 2021). Initially, the basic idea of economic growth was to liberate people from their material plight during the postwar years of the 20th century (Erhard, 1964). Yet, even though many countries seem to have long overcome post-war material hardship, the striving for positive economic growth rates continues to be the objective of worldwide politico-economic action.

The reasons for sustaining the growth paradigm, the so-called growth imperatives are diverse: On the one hand, economic growth acts as a stabilizing factor in the predominant socioeconomic system. The credit- or share-based funding of investments (Binswanger 2012; Paech 2019: 104), financing state expenditure through public debt (Easterly 2012), preventing high unemployment in the face of increasing productivity (Paech 2019: 109) and stabilizing the state-aided provision of social security systems (Klingholz/Slupina 2017: 42f) all require positive economic growth rates. On the other hand, there are cultural reasons requiring continuous economic growth like the human quest for social status and its increasing manifestation in the „conspicuous consumption" of products of symbolic character or prestige (Veblen 1899: 33ff; Paech 2019: 111) or the tempting possibility of handling the unequal distribution of income and wealth by increasing the distributional mass (Paech 2019: 114).

Since the first report on the *Limits to Growth* (Meadows et al., 1972), various publications have pointed out ecological limits to economic growth. On the one hand, the natural resources available to produce goods and services are limited. As the quantities of non-renewable raw materials as well as the regeneration ability of renewable raw materials are finite, the world's economy is subject to a planetary supply-limit (Rockström et al., 2009). On the other hand, the natural environment is only able to absorb the waste and emissions that are returned the biosphere to a certain extent: anthropogenic climate change reveals the limited ability of the ecosystem to absorb GHG emissions associated with increasing production and consumption (Hoegh-Guldberg et al., 2018). Therefore, it has been called for abandoning the growth paradigm and subscribe to de-growth instead (c.f. Wiedmann et al., 2020a).

It is often argued that the concept of economic growth in its most common understanding as measured e.g. by Worldbank (2021) describes the growth of real gross domestic product per capita and is thus conceptually independent of the scope of natural resource consumption (Hepburn and Bowen, 2013). However, despite this conceptual independence, there is empirical evidence that economic growth has been accompanied by an increase in GHG emissions and material throughput due to the contribution of resource- as well as emission-intensive goods and services to GDP: A global perspective

shows that global gross domestic product and material- as well as CO_2-footprints are correlated (Wiedmann et al., 2020a, Van der Voet et al., 2004). Due to this coupling of economic activity and GHG emissions, the question of the planet's ecological limitations always triggers the question of the limits of economic growth.

Especially regarding the advancing climate crisis and the associated disposal-limit for greenhouse gas emissions, the latest projections call for urgent action: As Parrique et al. (2019) point out, the reduction of GHG emissions needs to take place sufficiently fast and in a sufficient magnitude to avoid or at least alleviate irreversible damage to the planet's ecosphere. To meet the goals of the Paris Climate Agreement, assuming an equal carbon budget per capita and linear regression from 2018, net-zero emissions must be achieved by around 2032 to stay within the 1.5° limit at a probability of 50% (Rogelj et al., 2018). Yet, the carbon reduction targets of the agreement's signees fall way short of this ambitious goal: a projection conducted by the *New Climate Institute* suggests that if all current national reduction targets are met temperatures will increase by more than 2°, likely even surpassing the 4° mark (BMU, 2020).

Due to this pressing evidence from natural sciences, there is little doubt that GHG emissions must be reduced to achieve a sustainable path of economic development (Petschow et al., 2018). Yet, regarding the different means and ways to reach this path before reaching the tipping points of climate change, a conflict between the strategies termed *green growth* and *de-growth* arises in the economic discussion: is growth the solution, the best way to achieve the transition to sustainability; or is growth the problem, so that the growth paradigm needs to be overcome to achieve sustainability?

This conflict is aggravated by several problems: First, the issue at stake is complex and difficult to answer. Second, both strategies are fuzzy: the concept of green growth leaves open how "green" the envisaged growth ought to be (Jacobs, 2013) while the concept of *de-growth* has been used to refer to various (and potentially conflicting) policy proposals (Van den Bergh, 2011). Third, both strategies have potentially conflicting, highly value-laden connotations. The paradigm of (green) growth can be associated with the normative ideal of individual liberty, paired with the idea that governments should refrain from intervening in private affairs; the paradigm of de-growth can be associated with ideals of social responsibility, paired with the idea that governments should actively support the well-being of citizens (Rogowski, 2022).

In such a situation, there is a high risk that the economic debate about adequate policies becomes ideological. There are different definitions of ideology in economics. Some authors understand ideological as (inevitably) value-laden. We follow a more critical understanding in which statements are ideological for example if they only suggest truth but are difficult to verify or may even be immune against verification (Matiaske and Nienhüser, 2021). In this view, economic analysis is ideological if it is biased due to (conscious or sub-conscious) normative considerations (Rogowski, 2022).

This understanding does not imply the idea that economics could be a value-free science. Economics includes several research programs that analyze economic phenomena as market equilibria, as institutions, as complex systems, or as objective functions (Rogowski and Elsner, 2021). At least in their context of discovery or in their context of application, also all economic theories incorporate value judgments because they involve value-laden decisions of which aspects of (social) reality are selected in the analysis within a research program or its sub-fields (Schurz, 2014). Ideological economics arises, first, if those values and norms which make an economic research question relevant are not congruent with those values which inspired the theory used to solve this question. It arises, second, if apparently positive economic analysis serves for affirming rather than critically assessing preferred policy proposals (Rogowski, 2022). The more complex a subject matter (so that it is difficult to test statements empirically) and the more politically relevant its consequences (so that there are strong interest groups seeking for legitimizing their preferred proposals also by scientifically seeming evidence), the higher the risk of ideological economics (Rogowski, 2022). Given the complexity of the problem and the fuzziness of the two terms, this risk is thus rather high in the case of policy proposals associated de-growth or green growth.

In this article, our aim is to analyze the debate between advocates of de-growth and green growth against this background. First, we differentiate the two concepts alongside the terms of efficiency, consistency, and sufficiency in the literature on sustainability. Second, we summarize the main features of the green growth and the de-growth paradigms as well as key limitations and overlaps they face. Third, we identify their common ground and argue that they share important tenets so that, facing humanity's need to act quickly, focusing on the common ground appears more promising to us than polarizing and focusing on remaining differences.

Human economic activity affects the planet's ecosphere, e.g. regarding the loss of biodiversity, the pollution of waters as well as land areas, or the depletion of groundwater resources (Hautier et al., 2015, Wada et al., 2010, Rosenzweig et al., 2008, Rockstrom et al., 2009). For a full assessment of sustainability, besides carbon footprint, also other indicators like the material footprint (Lutter et al., 2016) would need to be included into the analysis. In the following, we focus on climate change for illustration, assuming that our considerations also bear on the other planetary ecological boundaries.

2. Green growth vs de-growth

2.1. Diverging paths to a sustainable economy

A simplifying, yet useful approach to distinguish the various impact-channels of human economic activity on the natural environment and to guide the search for

mitigation strategies is the so-called IPAT-equation. It models the ecological impact (I) of economic action as the product of population size (P), affluence (A) and the environmental impact of the current state of technology (T) (Chertow 2000). Assuming that active population control cannot be enforced under democratic conditions, decreasing the impact of human economic behavior on the environment involves either reducing human affluence and/or improving technology in terms of decreasing its environmental impact.

Given that there are two different and (at least in theoretical terms) coherent approaches to the sustainability transition of the economy, economists often disagree on which strategic path or strategy mix should be followed. This dissent is particularly evident in the question of whether and how the sustainability transformation can be achieved while maintaining economic growth. Therefore, based on these different starting points of the IPAT equation, the two strategic paths of green growth and de-growth have emerged both in the political and the academic discussion.

2.2. Innovation and green growth

2.2.1. Green growth: The main idea

Green growth, as pursued by the OECD (2011) or the European Commission (2019), is defined as "economic growth (growth of gross domestic product or GDP) which also achieves significant environmental protection" (Jacobs, 2013). To decouple economic growth from the growth in resource consumption and GHG emissions, green growth strategies rely on policies which raise the returns to ecological investments and innovations. Core focus are changes of the regulatory framework: Given that many natural resources or absorptive capacities are not priced, markets are assumed to fail and need correction by instruments like ecological taxes or certificates. These are paired with instruments like competition and innovation policy to mutually reinforce economic growth and the conservation of natural capital. Also, it includes policies to break unsustainable path dependencies like the creation of network infrastructure for next generation green technologies. Besides these, it involves labor market policies to preserve employment (not specific jobs) to facilitate a smooth re-allocation of workers from contracting to expanding sectors. These include, for example, training and re-training programs to facilitate the development of the new skills needed for greener production. To address regressive distributive effects like short term effects of increasing fuel prices, additionally targeted compensatory measures are implemented to alleviate the transitional costs of greening growth (OECD, 2011, European Commission, 2019).

Green growth focuses on the technological impact-channel of the IPAT equation as it encompasses diverse technological and organizational innovations. This includes, for example, new technologies to produce and store energy from regenerative sources, efficiency-enhancing innovations to reduce the material throughput of production or the logistics of transport and storage (Rennings and Rammer, 2009), or technologies which aim to capture carbon-dioxide from the atmosphere or directly absorb emissions at their point of origin (Gibbins and Chalmers, 2008).

In addition, *green growth* can be associated with consistency, the transformation to a circular economy, "a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops […] through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling" (Geissdoerfer et al., 2017). A circular economy has been assumed to induce positive effects on GDP as well as employment opportunities (Korhonen et al., 2018, Nasr et al., 2018, European Commission, 2020, Ellen MacArthur Foundation, 2013). Rather than only increasing in eco-efficiency (i.e., reducing inputs per unit of output) of the existing linear economy of producing, using, and throwing away, this involves ecological effectiveness (i.e. closing material flows): ideally, a circular economy consists of sustainable cradle-to-cradle material flow metabolisms. Already during each product's design, it is determined how the product's leftovers become raw materials at the end of a product's production process or its use. Products of consumption like food, textiles, or brake pads are consumed through physical degradation or abrasion and finally become fertilizer through biodegradation within biological cycle. Products of service are durable goods that render a service to consumers like televisions or washing machines. At the end of their use, they are returned to the manufacturer to close a technical cycle of manufacture, recovery and reuse (Braungart et al., 2007a)

Technically, the exit from fossil energy across all sectors appears not only feasible before 2050, but also more cost-effective than the current system (Ram et al., 2019). The same appears to be the case for other indicators of sustainability: Using best practices as benchmark and assuming exit from the fossil age, also the reduction of material footprints from currently 27 t (Pothen and Tovar Reanos, 2018) to about 8 t per capita (Dittrich et al., 2012b) could be achieved. Furthermore, if the energy transition above were achieved and carbon footprints had fallen to zero, the national footprint accounts indicate that even most countries in EU-28 and all countries in North America would have biocapacity reserves[1]. One-planet prosperity thus might be feasible (see also: Schandl et al., 2016b for a quantitative scenario modeling study).

There are various arguments in favor of green growth: For example, the natural environment can be seen as a production factor which was largely ignored by traditional

[1] Data from: https://data.footprintnetwork.org/#/, own calculation

growth theory and historic patterns of growth. Current growth patterns are inefficient because this production factor is undervalued (Jacobs, 1991) and there is ample evidence on the positive growth impact following from conservation and sustainable management of natural resources (UNEP, 2011). Also, the transformation to a sustainable economy involves the creation of new jobs in the newly developing environmental industries. Pioneers in this field can be argued to realize a first mover advantage, also on export markets, which outweigh the costs involved with environmental policies (Porter and van der Linde, 1995, Lanoie et al., 2008). More generally, low-carbon energy systems as well as other technologies for greening the economy have been argued to induce a new long wave of innovation like previously the steam engine or the microprocessor. Driven by information technologies, low-carbon "smart" energy systems, and new, more ecological circular production systems are argued to lead to new products and life styles with a dramatically lower environmental impact (Stern and Rydge, 2012). Therefore, it could be argued, that the concept of transformation to a sustainable economy can hardly be reached without green growth.

2.2.2. Green growth: The limitations

However, this has also been challenged. In particular, green growth strategies are associated with several technological imponderables which include the "residual risk of ineffectiveness" of carbon capture and storage or other (future) green technologies (Roser and Seidel, 2013, Hickel and Kallis, 2020), the possibility for undesirable side effects of innovative technologies (Parrique et al., 2019, Roser and Seidel, 2013), technological as well as ecological limits of recycling (Umweltbundesamt, 2019, Parrique et al., 2019, Bunge, 2016), and limits associated with biological cycles like those of the natural pace of regeneration of resources like wood from which the concept of "sustainability" was derived in the beginning (Daly, 1990, World Commission on Environment and Development, 1987).

The applicability of *green growth* strategies as adequate long-term solutions for successfully mitigating climate change relies on their ability not only to achieve absolute decoupling of economic growth from growth in greenhouse emissions but, even more, to achieve de-carbonization and de-materialization alongside economic growth before the increase in average global temperatures exceeds of 1.5-2° relative to pre-industrial levels (Hickel and Kallis, 2020, Parrique et al., 2019). However, if the current "Green" Growth measures are maintained, projections show a 4.2° increase in average temperatures by 2100; even if all efforts that are stipulated in the Paris Agreement are being implemented, projections show a 3.3° increase by 2100 (Hickel and Kallis, 2020).

Among others, Parrique et al. (2019) point towards several factors that hamper sufficiently fast absolute decoupling or even de-carbonization or de-materialization. Besides the empirical evidence that growth of GDP and growth of material and carbon

footprints have been correlated, the possibility for rebound effects counteract or even overcompensate the positive effects of increased efficiency (Umweltbundesamt, 2019, Hornberg et al., 2020, Roser and Seidel, 2013, Parrique et al., 2019). Further, incentives for outsourcing environmentally harmful production processes to other countries or regions are hard to abolish due to the lack of globally specified and sanctioned regulations (Hickel and Kallis, 2020, Parrique et al., 2019, Wiedmann and Lenzen, 2018).

2.3. Sufficiency and De-growth

2.3.1. De-growth: The main idea

Advocates of de-growth typically do not share the optimism that technological progress can decrease the ecological impact of production and consumption in a sufficiently large extent to achieve sustainability (c.f. Parrique et al. 2019). Consequently, they call for downscaling of economic activity to an ecologically sustainable level, which limits the prospects for positive growth rates.

While critics argue that this is unlikely to be acceptable to the population, advocates of de-growth point towards results of happiness research like the Easterlin paradox that which suggest that even if across individuals and countries higher income is associated with higher happiness, this is not the case with income growth over time (Easterlin, 1974, Stanca and Venhoven, 2015). Also, consumption habits do not necessarily satisfy genuine needs but partially arise from a social pressure to consume. In terms of Veblen (1899) households in high income countries may spend a significant share of those incomes on "conspicuous consumption", that is, consumption that is meant to document their social status in comparison to other households. This status-oriented spending generates negative external effects on other households and, as a result, total consumption in a society may be excessively high (Howarth, 1996). This effect has been identified for cars and may help explaining the Easterlin paradox (Stanca and Venhoven, 2015, Okulicz-Kozaryn et al., 2015)

The call for de-growth is also motivated by a global equity perspective and the observed correlation between high levels of affluence and the overuse of the Earth's natural capacities (Global Footprint Network, 2020): If all people have the right to an equal share of natural consumption, countries with a satisfactory level of prosperity ought to reduce their share of natural consumption to allow countries with low levels of affluence a reasonable level of prosperity without overusing the world's ecological capacities (Roser and Seidel, 2013, Wiedmann et al., 2020a, Dittrich et al., 2012a).

De-growth is not a uniformly defined concept but a term which is used in different contexts to convey different meanings (D'Alisa et al., 2015). However, following the

failure of the current growth regime to address the challenge of sustainability, common to all calls for De-growth is the rejection of the pursuit of economic growth as a superordinate politico-economic goal. Positively, de-growth can be defined as "a socially sustainable and equitable reduction (and eventually stabilization) of society's throughput" (Kallis, 2011) which ought to occur voluntarily and which could be either initiated by governmental action or by grassroot initiatives spreading the idea of a sufficient way of living (Wiedmann et al., 2020a, Cosme et al., 2017). De-growth concepts argue that a sustainable design of the economy can only be achieved with noticeable changes in existing consumption patterns. Therefore, de-growth concepts often refer to sufficiency practices which include "absolute reductions, modal shifts, product longevity, and sharing practices" to reduce resource consumption and overall greenhouse gas emissions (Sandberg, 2021).

Accordingly, a recent review of academic de-growth policy proposals identified three broad goals targeted by de-growth policies: "Goal 1: Reduce the environmental impact of human activities"; "Goal 2: Redistribute wealth and income within and between countries"; and "Goal 3: Promote the transition from a materialistic to a convivial and participatory society" (Cosme et al., 2017).

The published policy proposals pursuing these goals are very diverse. For example, Cosme et al. (2017) identified 36 proposals targeting the first goal which could be divided into the fields of consumption, ecological conservation, infrastructure, pollution, production, resource use and trade. Proposals targeting consumption included promoting changes in consumption patterns or regulating advertisement. Proposals targeting infrastructure included, for example, directing investments away from car-based transport or moratoriums on new infrastructure more generally. To reduce the environmental impact of production, proposals included policies to promote organic farming, the introduction of simpler technologies, more green investments or regulatory bans for very harmful technologies like nuclear energy. Proposals addressing trade included strong social and environmental provisions in trade agreements, limits on trade distances and volumes, or incentives for local production and consumption (Cosme et al., 2017).

In standard macroeconomics, zero or negative growth amounts to recession or stagnation. It is associated with economic hardships such as job losses, bankruptcies, and increasing poverty. In a non-growing economy economic growth can no longer serve as a stabilizing factor in the socio-economic system. Therefore, the 2nd de-growth policy goal of re-distributing income and wealth to address these hardships play an important role in the de-growth literature. Following the review of Cosme et al. (2017), the academic degrowth literature appears even "more focused on social equity than on environmental sustainability". The review lists 24 policy proposals for this goal, like "Create a basic/citizen's income"; "Promote community currencies, non-monetary exchange systems, and alternative credit institutions"; "Promote the recognition and management

of common goods"; "Decrease unemployment"; or "Promote job-sharing and work-sharing" (Cosme et al., 2017).

Also, to promote the 3rd goal, the transition to a non-materialistic society, advocates of de-growth have proposed various policies which can be subsumed among the topics "Community building, education and value change", Democracy and participation, "Free time", and "Voluntary simplicity and downshifting". For example, to maintain high employment while the production volumes of non-growing economies decline, advocates of de-growth propose re-assessing individual labor-leisure-decisions so average working hours can be reduced (Lange, 2018, Heikkinen, 2015, Bilancini and D'Alessandro, 2012, Paech, 2019). Investments in technological innovations should focus on improving resource productivity rather than labor productivity to mitigate the losses in the demand for working hours (Paech, 2019, Lange, 2018).

2.3.2. *De-growth*: The limitations

Theoretically, reducing consumption is a straightforward approach to keep economic activity within sustainable limits, and in wealthy industrialized nations there is little doubt that basic needs like sufficient nutrition, clothing, nurture, etc. can be obtained by lower carbon and material footprints.

However, there is a lack of empirical research on zero or negative growth scenarios as well as the associated policy proposals (Wiedmann et al. 2020: 7). Therefore, critics are skeptical that de-growth policies are suited to reach their goals of reducing production or consumption. For example, it is unclear whether working time reduction does indeed reduce environmental pressures. A recent systematic review by Antal et al. (2021) identified a number of studies which concluded that reduced work time lead to decreasing incomes and, in consequence, decreasing consumption expenditures associated with lower environmental pressures. However, effects of time use changes or possible impacts in production processes have proven difficult to establish. Calls for work time reduction are frequently paired with calls for a basic income. Assuming that such a basic income transfers income from wealthier individuals with lower income elasticity of consumption to those with higher income elasticity, more time (which could be used for consuming) paired with a basic income (which increases consumption possibilities) may even increase overall consumption – at least, unless the reductions of gross national incomes are drastic which (at least from the viewpoint of green growth advocates) is likely to evoke strong opposition among the citizens.

Related to this, sufficiency strategies are frequently perceived as patronizing and overcharging (Linz, 2004). Either sufficiency is expression of genuine preferences – then it could occur also without government intervention among those who prefer more leisure in their decision between consumption and paid labor. Or it is not - then, neoclassical

economic theory would suggest that caps on salaries, working time, or consumption may induce evasive reactions like black markets rather than promote sufficient life-styles.

Given that sufficiency-oriented behavior is not widespread practice, the preferences of the population may simply not be in line with de-growth's core ideas. Preferences are not easy to change so that calls for de-growth education or value change would need to be backed by evidence that the investment of scarce public funds would achieve, at least, what they aim at. Also, in democracies, any compulsory measures would additionally need sufficient justification (and, practically, sufficient political support) to be implemented which is not easy to achieve (Linz, 2004).

Finally, in contrast to wealthy societies, in cases of low affluence material wealth is vital for the fulfillment of basic human rights (Roser and Seidel, 2013). As most of the earth's population lives in conditions of low affluence, sufficiency and the renunciation of consumption is applicable to selected parts of the world only.

3. Towards a common ground

3.1. Theoretical common ground

These elements include, first, that after thorough inspection, the concepts are quite difficult to disentangle; second, assessing the concepts through scientific glasses, much of the conflict appears to arise around ideologies rather than facts.

3.1.1. Conceptual overlap

The concept of green growth leaves open how significant the environmental impact ought to be (Jacobs, 2013). Those who use the term may thus refer to policies of conventional growth with further relative decoupling (Hepburn and Bowen, 2013) or small-scale absolute decoupling in an order of 3% per year (Schandl et al., 2016a). However, in our view, taking the liberal ideals associated with neoclassical economics serious requires our generation to make sure that future generations are not hampered in their freedom to pursue the life style they wish to pursue (World Commission on Environment and Development, 1987). As a consequence, "green" needs to be taken as the necessary and "growth" as the sufficient condition of the green growth paradigm. Changing the prices of carbon emissions or primary raw materials in a way to ensure the transition to a carbon neutral may induce shocks to an economy which may, at least temporarily, lead to negative GDP growth (as the oil price crisis did in the 1970s). Nevertheless, this is not necessarily a hindrance for pursuing growth-oriented policies informed by neoclassical economics.

The concept of de-growth leaves open what types of "sufficiency" should be achieved, by which measures, and what types of socially oriented policies should accompany them. The term has been used to call for radical ideas like eco-socialism or eco-anarchism (Wiedmann et al., 2020b) which are unlikely to be acceptable from the viewpoint of democratic majorities. Also, these may be difficult to reconcile with the definition of de-growth as "voluntary transition towards a just, participatory, and ecologically sustainable society" (Cosme et al., 2017). However, de-growth in the sense of changing consumption patterns to less material-intensive life styles are not necessary excluded by the green growth paradigm: If market failures are corrected so that prices reflect planetary scarcities, it is likely that new, dematerializing services are going to arise. For example, if prices of individual private mobility rise, mobility services which combine car rental and public transport are likely to induce a de-materialization of transport alongside with concepts termed "sharing" in the de-growth paradigm. Comparing a well-organized public train journey which includes a tasteful meal and time to read a book or work with a private car journey on jammed highways, the mobility service is likely not only to use less resources but at the same time to create more value to the consumer of mobility than private mobility. Apart from such indirect influence on consumption patterns, green growth policy proposals frequently also include measures to directly change consumer behavior (see e.g. Prognos et al., 2021).

Also, innovation driven efficiency and consistency efforts as well as policies derived from neoclassical economics are not rejected within the de-growth paradigm, as they may mitigate the ecological impact of human economic activity to a certain extent (even if advocates of de-growth stress the importance of accompanying sufficiency practices) (Hornberg et al., 2020, Jackson and Senker, 2011, Paech, 2019, Victor, 2018, Wiedmann et al., 2020a). Likewise, the de-growth goal of ensuring a fair distribution of income and wealth can also be found in green growth-oriented policy proposals (Prognos et al., 2021, OECD, 2011).

3.1.2. Theoretical common ground

Although the two schools of thought disagree on the role of economic growth in achieving environmental sustainability goals, they share common ground regarding a number of theoretical considerations. First, both schools of thought share core normative ideals as they are driven by ecological concerns, seeking to keep human economic action within the ecological boundaries of the planet. Second, both de-growth and green growth approve efficiency and consistency. The larger the decoupling effects of efficiency- and consistency-based measures, the less sufficiency is necessary to meet the required goals in the given time horizon. Third, given democratic premises, both schools of thought should be able to agree on fundamental values of individual sovereignty and seek for ways to balance individual freedom and the necessary rules and social, political will to address the ecological challenges. These shared ideals are a valuable point of reference for debating the remaining disagreements.

Furthermore, even if de-growth is frequently associated with opposition to purely market-based economic policies and economic analysis focusing on neoclassical mainstream only, marked-based economies neither rely on nor automatically generate

growth (Irmen, 2011). There is nothing in neoclassical theory that suggests that economies must grow over time. On the contrary, neoclassical models usually assume that the economy reaches a state of general equilibrium in which all key variables are constant or growing at constant rates. In terms of growth theory, this situation is called a "steady state" or "balanced growth path". Depending on the details of the model and the setting of parameters, the rate at which the key variables grow in this "steady state" could be larger than zero, equal to zero, or smaller than zero. Thus, a non-growing economy could be compatible with full employment and price stability within the neoclassical theory (Kallis et al., 2018). The neoclassical framework can thus serve as one shared reference in theoretical discussions under certain conditions. For example, the theory of public goods, which is firmly based on neoclassical assumptions, often produces results that are very much in line with the policy ideas of those who do not accept the neoclassical theory.

Most importantly, both sincere advocates of de-growth and green growth would agree that there is no room for business as usual any longer but that there is an urgent need to transform current economic practices to sustainable ones. This is an important shared point of reference for discussing the best way forward.

3.1.3. Science vs. ideology in the growth debate

Climate change is a complex phenomenon which emerges from a multi-facetted array of causes and there are various well-developed economic perspectives that can help understanding it (Rogowski and Elsner, 2021). Not only for individuals in the political sphere but also for economists it is tempting to reduce this complexity by ideological rather than evidence-based economic analysis: by sticking to a familiar, preferred solution and selecting those theories and empirical facts which confirm one's prejudices; or, by analyzing the topic through the lenses of one preferred economic research program which incorporates familiar and shared value judgments – instead of assessing policy proposals one by one concerning (1) plausibility of the (economic) theory and fit with the facts about the problem it aims to solve; (2) fit of value judgments that render a phenomenon problematic with the value judgments incorporated in the economic theory to solve the problem; and (3) empirical evidence of effectiveness of a policy to achieve what it aims at (Rogowski, 2022).

Given that de-growth and green growth are both fuzzy concepts which are highly value-laden and associated with preferred policies, they are particularly susceptible to this problem. This is also, because for their advocates, the normative power of their concept is self-evident: if growth is a good thing and being green solves the sustainability question, how could green growth be something bad? Or, if growth (of carbon and material footprints) is the problem, how could de-growth paired with some kind of fair distribution be something bad?

However, given the above, the conflicts between de-growth and green growth may primarily be located in the corresponding ideologies: if concepts or policies are favored or rejected in principle rather than assessing in an evidence-based manner what they can achieve for a certain purpose. For example, while green-growth associated policy proposals based on a "markets solve everything" ideology are likely to meet opposition by advocates of a de-growth associated "anti-market" ideology, in a rational discourse, both would agree that a policy of internalizing external costs by carbon taxes or certificates which is based on neoclassical environmental economics (Rogowski and Elsner, 2021) is an important measure to decrease carbon emissions.

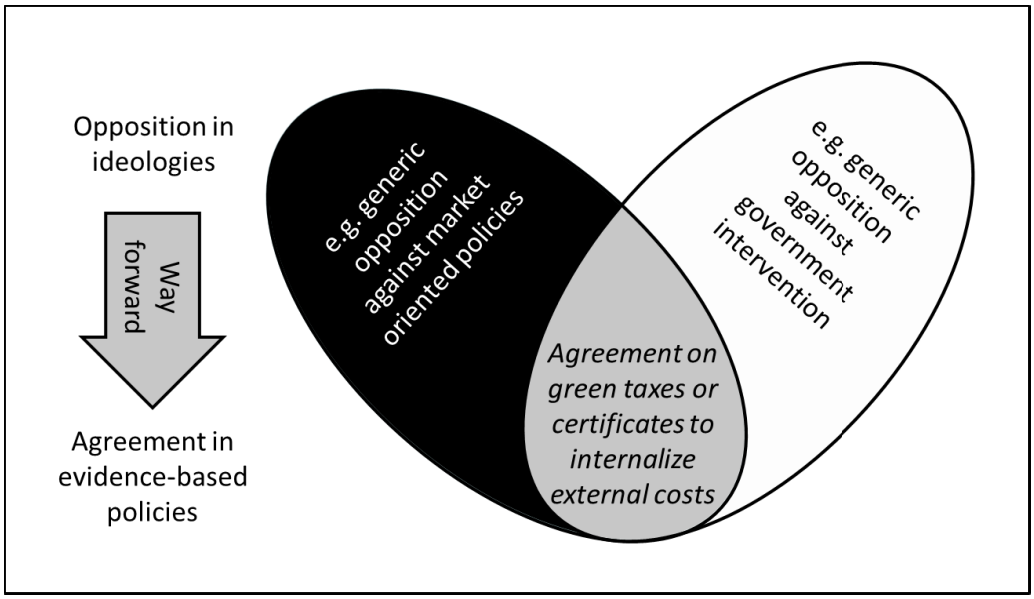

Figure 1: Generic opposition but evidence-based agreement on economic policies

3.2. Practical common ground

On a policy level, there are a number of implications both schools of thought are consistent with. These include the following.

3.2.1. Exit the fossil age

Theoretically, the solution to the climate crisis is straightforward: A large share of global warming can be attributed to the consumption of fossil fuels (Owusu and Asumadu-Sarkodie, 2016) and a 100% renewable energy scenario could reduce global carbon emissions by about 90% by 2050 (Pursiheimo et al., 2019). Fossil fuels thus should be replaced by regenerative energies sooner rather than later. Replacing fossil fuels by regenerative alternatives like hydrogen-based solutions, the transformation to renewable energy sources is technologically possible as well as economically feasible in the foreseeable future (Prognos et al., 2020). Furthermore, the transition towards a 100% renewable energy scenario could not just reduce global carbon emissions by about 90%

by 2050 (Pursiheimo et al., 2019), but could potentially reduce average energy costs by 75% and electricity prices by 25% (Jacobson et al., 2018, Breyer et al., 2018, Löffler et al., 2017).

3.2.2. Foster recycling, circular economic activity, and the right to repair

Fostering circularity offers the "opportunity to mitigate some of the tensions between economic, environmental, and social priorities set out by the United Nations' Sustainable Development Goals" (Nasr et al., 2018). Therefore, it appears to be a promising strategy for closing the gap between innovation and sufficiency oriented approaches (Korhonen et al., 2018). By adapting the product design, recycling schemes and technology as well as regulatory adjustments, the use of resources over (infinitely) many life cycles of the resulting products can reduce the corresponding GHG emissions (ASA et al., 2020, Kirchherr et al., 2018). In addition to the positive ecological effects, the transformation towards a circular economy is likely to be associated with positive effects on the disposable household income and GDP (Ellen MacArthur Foundation, 2013) as well as employment opportunities (Korhonen et al., 2018, Nasr et al., 2018, European Commission, 2020). Concepts and certificates for value retention processes such as remanufacturing, refurbishment, reuse, and repair already exist yet remain to be comprehensively adopted by the respective legal authorities (Hernandez et al., 2020, European Parliament, 2020, Nasr et al., 2018, Ministry of Ecological and Solidarity Transition, 2020, Braungart et al., 2007b).

3.2.3. Correct wrong prices

One widely shared strategy to exit the fossil age and promote circularity is correcting wrong prices. Since Pigou's *The Economics of Welfare*, it is well known that markets fail in case of (negative) external effects (Pigou, 1920, Dahlman, 1979): In the absence of regulatory measures, there is a lack of incentives for private firms to factor in the ecological and social costs of their economic activities, leading to inefficiently low prices from a social perspective. This is the case also for carbon emissions: the European Emission Trading System only covers around 50% of total GHG emissions (Bayer and Aklin, 2020). Also, the carbon price is well below the 2020 benchmark price of 60€ per ton of CO_2 in most OECD countries and sectors (OECD, 2021). Because prices for primary resources do not adequately reflect ecological costs, their relatively low costs impede the broad use of secondary materials from recycling processes and limit the economic feasibility of circular production patterns (Hornberg et al., 2020, Kirchherr et al., 2018). The case for correcting these negative external effects through ecological taxes becomes even stronger if one considers the possibility of recycling the tax revenue in such a way that a "double dividend" is achieved, for example in the form of lower emissions and lower unemployment (Kronenberg, 2007). Even if there may be disagreements on whether ecological taxes (Pigou, 1920) or certificates (Coase, 1960, Crocker, 1966, Dales, 1986) are most appropriate for correcting these wrong prices, both advocates of green growth and of de-growth agree on the problem and potential

solutions. Also, they agree that environmentally damaging subsidies, e.g. for aviation or the extraction of fossil fuels, need to end.

3.2.4. Ensure equitable burden

Generally, considerations of equity and social justice play a prominent role in the de-growth discussion while traditionally, they receive lower attention by market-oriented advocates of green growth. However, it can be shown empirically that carbon pricing schemes tend to result in a regressive tax incidence, as low-income households spend a larger share of their income on carbon intensive products (Grainger and Kolstad, 2010, Williams III et al., 2015, Fremstad and Paul, 2019). To ensure the acceptability of these regulatory reforms, advocates of both schools of thought are likely to favor offsetting these distributional effects. This can be achieved, for example, by a reduction of labor income taxes (Williams III et al., 2015), lump-sum carbon dividends (Fremstad and Paul, 2019) or other policies relieving the financial burdens for low-income households (Grainger and Kolstad, 2010).

3.2.5. Provide infrastructure for sustainable transport solutions

Besides socially balanced monetary incentives, there are further measures necessary to accelerate the path to a sustainable economy and overcome fossil path dependencies, which are likely to be based on public rather than private investment. Many infrastructure systems, especially grid-bound infrastructures, are characterized by extremely high fixed costs and comparatively low (marginal) costs. According to the theory of natural monopolies, a purely marked-based solution may fail to provide the optimal amount of infrastructure services. This is particularly the case for energy infrastructures, e.g. in the form of new power supply lines to transfer electricity across regions, infrastructure for energy storage, or for a hydrogen economy. Also, new and modified transport infrastructures are needed, e.g. in the form of electrification of roads or the expansion of public transport. Furthermore, heat networks can increase the efficiency of carbon neutral energy production and storage and facilitate carbon-neutral heating in cities (Prognos et al., 2021).

In some cases, it may possible to use the existing infrastructure more efficiently than in the past, for instance in the case of international travel by railroad. Currently travelers face a maze of competing national railroad companies which makes it difficult to book safe and reliable long-distance trips. Better coordination of ticket reservation systems could make international railroad trips more attractive compared to international flights. Therefore, it has been argued that rail data sharing should be made mandatory in order to facilitate the planning and booking of long range trips by train (Donat et al., 2020). Such measures could improve the quality of railways services on the existing physical infrastructure and would not require massive expenditure on new infrastructure.

3.2.6. Enable sufficiency-oriented job market decisions

While proponents of de-growth envision a society with massively altered lifestyles, advocates of green growth are typically reluctant to endorse interference in the lifestyle choices that individuals make for themselves. This apparent problem can be overcome by realizing that in many situations an *increase* in individual freedom – rather than a *decrease* – would allow individuals to choose life styles that are more sustainable than currently. Hence, promoting freedom of choice involves enabling sufficiency.

Current labor market institutions make it hard for individuals to choose the "right" amount of work and income, and many workers are stuck in a situation in which they work more than they want. A 2017 survey of German employees, for instance, revealed that 49% of respondents wanted to reduce their working hours while only 12% wanted to increase them (Brauner et al., 2018). More freedom with respect to the choice of working time would allow these workers to reduce their working time and, from a neoclassical point of view, would increase economic efficiency. Moreover, the individual reduction in working hours would probably result in an overall reduction of working hours at the macro level, a process that would be in line with the ideas of de-growth proponents.

There is thus little reason for any advocate of green growth to oppose individual decisions to exit the golden cage of abundance (Paech, 2019) and enjoy the freedom associated with more sufficient life styles – as long as it is voluntary and not enforced by a patronizing state. However, to allow sufficiency lifestyles, regulations for flexible leisure labor decisions may be needed (c.f. Antal et al., 2020).

3.2.7. Inform the consumer

Sustainability is of increasing importance to customers (Wojnarowska et al., 2021, Akhtar et al., 2021), but a lack of knowledge on the ecological impact of products limits ecologically conscious purchasing behavior (Joshi and Rahman, 2015, Gleim et al., 2013). Without better consumer information, only producers are aware of the environmental impacts of their products. This leads to information asymmetries and ultimately to (ecologically) inefficient market outcomes (Nikolaou and Kazantzidis, 2016, Peattie, 2010, Chang et al., 2020, Van Amstel et al., 2008). Thus, aside from monetary incentives, improving the information base is important to empower the individual to make sustainable consumption decisions (Hornberg et al., 2020, Wojnarowska et al., 2021). This could be achieved for example, by standardized, trustworthy information on a product's ecological impacts in formats like a "second price tag" which reveals the products ecological costs (Wojnarowska et al., 2021, Atkinson and Rosenthal, 2014, Hornberg et al., 2020).

3.2.8. Commit to green public procurement

Also, even if advocates of green growth tend to hold market-oriented ideals and to dislike government interference into private consumption, public procurement is a different matter. As public procurement accounts for a large share of GDP and the corresponding GHG emissions, covering 15% of total GDP and at least 12% of emissions in Germany (Chiappinelli et al., 2019), reducing the emissions of publicly planned economic activities is an important aspect in the reduction of overall emissions (Hornberg et al., 2020). This includes also activities, which are frequently subject to public funding like healthcare (Salas et al., 2020, Pencheon and Wight, 2020).

Overcoming the barriers of sustainability in public procurement not only promises to be an effective tool for reducing the directly associated GHG emissions, but is also said to boost the development of sustainable products: Alvarez and Rubio (2015) argue, that implementing sustainability criteria in public procurement regulations can foster sustainable innovation. In sectors where governments have sufficiently large purchasing power, green public procurement can set intersectoral standards for sustainability, even though Cheng et al. (2018) note, that further research on innovation spillovers is necessary to draw general conclusions.

3.2.9. Develop resilience against economic crisis and recession

Given the perils of uncontrollable decline of economic growth within recessions or because of environmental degradation, exploring further strategies of coping with a non-growing economy may be a matter of political prudence even for those who subscribe to a growth rather than a de-growth paradigm. If – despite best efforts – ecological pressures persist and a cutback of economic action becomes inevitable, it is foresighted to have a well-founded "emergency break" at hand. Thus, to avoid systemic inertia in a case of economic degradation for environmental (or other) reasons, research on fundamental academic understanding about the functionality and interdependencies of stable (temporarily) non-growing economies at the systems level as well as the associated cultural and governance challenges (Wiedmann et al 2020: 7f) should not be neglected.

3.2.10. Pursue evidence based policy

Eventually, not the ideology of green growth or de-growth should be the judge of which policy measures are pursued, but instead, the most plausible theories and the best available empirical evidence. There is a plurality of research programs in economics which shed light on different aspects which hamper or promote the transition to a more sustainable economy (Rogowski and Elsner, 2021). Also, there are

shared sustainability targets like the greenhouse gas emission targets by IPCC which can serve as benchmarks for policy appraisal. Scientific predictions can never be certain in a complex policy environment, and the search for evidence should not rule out pursuing policies which are most likely to meet the aims they are pursued for (Rogowski, 2010). However, methods of policy evaluation and evidence synthesis are well developed to allow for at least some indication of how well specific policies are suited to deliver the results they were developed for (see e.g. the standards developed within www.equator-network.org for health research).

4. Conclusion

The notion on whether maintaining economic growth can be compatible with keeping global warming below 1.5-2° is fundamentally different between advocates of green growth and de-growth. At first sight, the scientific as well as political discourse between the two schools of thought seems to be deadlocked. Advocates of both strategies refer to their respective approach as the only viable solution to synergize economic, social, and environmental sustainability. However, in our view, both the polarization of the discussion and the derivation of supposedly no-alternative solutions are rather detrimental to overcoming the climate crisis. Therefore, we propose focusing on the shared set of theoretical assumption and policy implications to overcome the deadlocked theoretical discourse and speed up the reduction of overall GHG emissions.

Maybe the most important shared insight of both de-growth and green growth advocates is that there is urgent need for action to resolve the climate crisis before it is too late. We hope this synthesized view provides a lever for implementing these policy imperatives and to speed up the transition towards a sustainable economy.

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